(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 456 347 B2

(12) **NEW EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the opposition decision:
31.03.1999 Bulletin 1999/13

(45) Mention of the grant of the patent:
15.02.1995 Bulletin 1995/07

(21) Application number: **91302770.2**

(22) Date of filing: **28.03.1991**

(51) Int Cl.[6]: **C10M 133/08**, C10M 133/16, C10M 133/52, C10M 159/12, C10M 159/16, C08F 8/00, C08F 10/00, C07D 207/404 //(C10M159/12, 129:66, 133:52, 133:56), C10N30:04, C10N60:06, C10N70:00

(54) Lubricating oil additives, their preparation and use

Schmieröladditive, ihre Herstellung und ihre Verwendung

Additifs pour huile lubrifiante, leur préparation et leur utilisation

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI NL SE

(30) Priority: **31.03.1990 GB 9007335**

(43) Date of publication of application:
13.11.1991 Bulletin 1991/46

(73) Proprietor: **LUBRIZOL ADIBIS HOLDINGS (UK) LIMITED**
Wirral, Merseyside L62 4SH (GB)

(72) Inventor: **Carlisle, William Daniel,**
BP Chemicals Limited
Hull HU12 8DS (GB)

(74) Representative: **Crisp, David Norman et al**
D. YOUNG & CO.
21 New Fetter Lane
London EC4A 1DA (GB)

(56) References cited:
EP-A- 439 885
EP-A- 0 183 478
FR-A- 1 279 081
FR-A- 1 415 006
GB-A- 1 065 595

- **DATABASE WPIL, AN=75-77867W, Derwent Publications Ltd, London, GB;& JP-A-50 102 685 (UNITIKA)**

EP 0 456 347 B2

Description

[0001] The present invention relates generally to lubricating oil soluble compounds suitable for use as dispersant additives in lubricating oils, their preparation and uses thereof.

[0002] Multigrade lubricating oils typically are characterised by two numbers such as 10W30, 5W30, and the like. The first number in the multigrade designation is associated with a maximum low temperature (eg - 20°C) viscosity requirement for that multigrade oil as measured typically by a cold cranking simulator (CCS) under high shear, while the second number in the multigrade designation is associated with a minimum high temperature (eg 100°C) viscosity requirement. Thus, each particular multigrade oil must simultaneously meet both strict low and high temperature viscosity requirements in order to qualify for a given multigrade designation. Such requirements are set, for example, by ASTM specifications.

[0003] The minimum high temperature viscosity requirement is intended to prevent the oil from thinning out too much during engine operation thereby leading to excessive wear and increased oil consumption. The maximum low temperature viscosity requirement is intended to facilitate engine starting in cold weather and to ensure pumpability.

[0004] In formulating an oil which satisfactorily meets the extremes of viscosity requirements the formulator may use a single oil of desired viscosity or a blend of two lubricating oils of different viscosities at the same time as manipulating the nature and amounts of additives that must be present to achieve the overall target properties of a particular multigrade oil including its viscosity requirements.

[0005] In general, in order to meet the low and high temperature viscosity requirements of multigrade oils, it is necessary for the formulator to employ an additive conventionally referred to as a viscosity index (VI) improver. These generally function to increase the low temperature viscosity of the base oil to a lesser extent than they increase the high temperature viscosity. A complication for the formulator is the effect on the viscosity requirements posed by other lubricating oil additives, and in particular dispersants, which are added to prevent sludge flocculation and precipitation, the sludge being formed by oxidation of the oil. A problem with many existing dispersants is their low viscosities at higher temperatures.

[0006] The present invention seeks to overcome the problem associated with prior art dispersants by the provision of lubricating oil soluble compounds suitable for use as dispersants having improved VI characteristics.

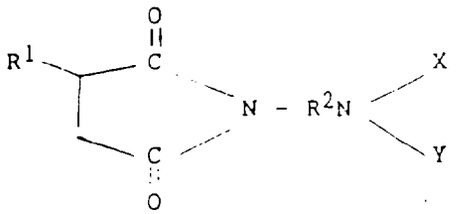
[0007] Accordingly, the present invention provides a process for preparing an oil soluble compound suitable for use as a dispersant additives, which compounds is obtained by reacting at elevated temperature an epoxyacrylate with a dispersant having at least one reactive nitrogen - containing moiety in two or more sequential steps, comprising a first step of reacting the dispersant at elevated temperature with epoxyacrylate, and in a further process step or steps involving the addition of further dispersant, reacting the product from the preceding step or steps with further dispersant.

[0008] Any dispersant having at least one reactive nitrogen - containing moiety may be employed. Thus dispersants having primary and/or secondary amino groups may be employed but not those containing exclusively tertiary amino groups. It is believed, though we do not wish to be bound by any specific theory, that reaction occurs between the reactive nitrogen - containing moiety of the dispersant and both the epoxy and the olefinically unsaturated groups of the epoxyacrylate in a manner such that the dispersant is crosslinked by the epoxyacrylate molecules.

[0009] Suitable dispersants include (i) oil-soluble amides or imides of long chain hydrocarbyl-substituted mono- and dicarboxylic acids or their anhydrides, (ii) long chain hydrocarbons having a polyamine attached directly thereto, and (iii) Mannich condensation products formed by condensing a long chain hydrocarbyl-substituted hydroxy aromatic compound, for example an alkyl phenol, with an aldehyde and a polyalkene polyamine, which adduct contains at least one reactive amino group.

[0010] The dispersant is preferably an imide or amide formed by the reaction of a polyalkene substituted succinic acylating agent and an amine. Succinimides are a well-known class of dispersant useful in the process of the present invention. Typical of the art relating to such materials is GB-A-1565627 and the prior art acknowledged therein. Typically, they are prepared by reacting a polyalkene, in the presence or absence of chlorine, with either maleic acid, or preferably maleic anhydride, to produce a polyalkene-substituted succinic acid or anhydride and thereafter reacting the polyalkene-substituted succinic acid or anhydride with a nitrogenous material. suitably an amine, which may be a mono-, di- or polyamine.

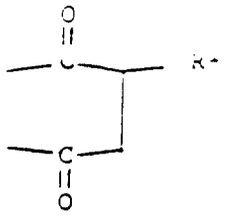
[0011] A suitable succinimide has the formula:-



(I)

where in R^1 is a hydrocarbyl group, typically a polyalkene group having more than 30 carbon atoms, R^1 preferably contains between 30 and 300 carbon atoms, more preferably between 50 and 150. R^1 is preferably a polyisobutene group. R^2 is a divalent group such that H_2NR^2NXY is an alkylene amine, such as an ethylene or propylene amine, eg R^2 is $-(CH_2CH_2NH)_kCH_2CH_2-$ where k is zero or an integer from 1 to 7, preferably 2 to 6; alternatively a mixed ethylene/propylene amine e.g. $H_2N(CH_2)_3NH(CH_2)_2NH(CH_2)_3NH_2$ can be used,

X and Y are independently either hydrogen, alkyl, preferably C_{1-6}, more preferably methyl or ethyl or hydroxy alkyl, preferably C_1-C_6, most preferably hydroxy-ethyl, or together form the group:-



(II)

[0012] Alternatively, R^2 in the formula (I) may be a divalent group such that H_2NR^2NXY is an alkanolamine or a polyether amine. Typically such alkanolamines may contain the group $= N.CH_2CH_2NH.CH_2CH_2OH$ (i.e. $R^2=CH_2CH_2$, X=H, $Y=CH_2CH_2OH$) and typically such polyether amines may contain the group $= N.CH_2CH_2O\,CH_2CH_2OCH_2CH_2NH_2$ (i.e. $R^2=(CH_2CH_2O)_2CH_2CH_2-$, X=Y=H). Useful commercially available polyether amines are the Jeffamines (RTM) marketed by Texaco. R^2 is preferably an alkylene group, eg of 2 to 40 carbons, optionally interrupted with at least one 0 or NH group, and in particular contains one or more units of alkylene oxa or alkylene amino groups each of 2 to 4 carbons.

[0013] R^2 may also be a divalent group such that H_2NR^2NXY is an aromatic or araliphatic amine, eg of 6-20 carbons such as phenylene or biphenylene diamine or bis(amino benzyl).

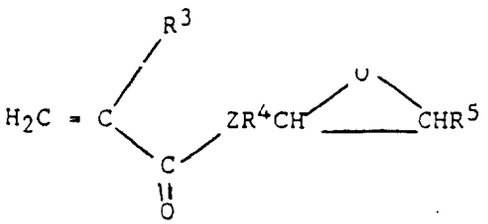
[0014] Where one of X and Y is hydrogen, R^2 may be an alkylene group e.g. $-CH_2CH_2-$. It is preferred that the dispersant used in the present invention contains at least 2, preferably from 3 to 7, active nitrogens (i.e. primary or secondary).

[0015] Suitably in the formulae (I) and (II) R^1 is derived from either ethylene, propylene, 1-butene, isobutene, 1-hexene, 1-octene and the like. Alternatively, the polyalkene may be derived from an internal olefin, eg 2-butene, or an interpolymer, eg an ethylene propylene/copolymer. Preferably the polyalkene is a polyisobutene.

[0016] The succinimide may be either a mono- or bis-succinimide.

[0017] For the purposes of the present invention, an epoxyacrylate is defined as a compound comprising at least one oxirane ring and at least one acrylate or acrylamide group, including alpha substituted derivatives of acrylate and acrylamide groups.

[0018] Epoxyacrylates useful in the present invention may suitably be those having the formula:-



(III)

wherein R^3 and R^5 are independently either hydrogen, a hydrocarbyl or a hetero- (eg 0) substituted hydrocarbyl group, R^4 is alkylene, alkylene glycol, arylene or a group containing at least one of an acrylate acrylamide or oxirane group,

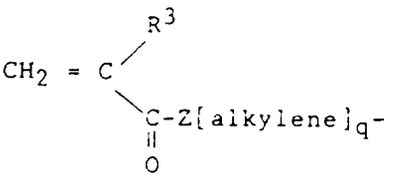
eg alkylene, acrylate (or its amine derivative). Preferably R^3 is either hydrogen or a hydrocarbyl group, eg of 1-20 carbons. Suitably the hydrocarbyl group may be either alkyl, cycloalkyl, aryl or alkaryl, preferably alkyl, eg of 1-6 carbons. Z is a heteroatom, or a substituted heteroatom, for example -0- or = NR^6 where R^6 is hydrogen or an alkyl group, eg of 1-6 carbons such as methyl or ethyl.

[0019] In formula III, where R^4 is alkylene, eg of 1-300 or 1-10 carbons, it is suitably of the formula $-[CHR^7]_n-$ where R^7 is hydrogen or a C_1-C_{20}, preferably C_1-C_6, more preferably methyl or ethyl; n is an integer from 1 to 30; each of the n groups R^7 can be the same or different. The group R^4 is suitably derived from a polyolefin for example where R^7 is hydrogen, R^4 will typically be derived from polyethylene. R^4 is preferably $-CH_2-$.

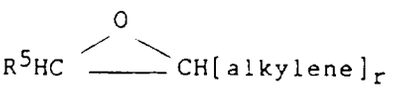
[0020] Where R^4 is an alkylene glycol, it is suitably of the formula $-[CHR^8CHR^9O]_mCHR^8CHR^9-$ where R^8 and R^9 are independently hydrogen, or a C_1-C_{25}, preferably C_1-C_{16}, more preferably C_1-C_6 alkyl group, for example methyl or ethyl, m is an integer from 1 to 10. Preferably R^8 is hydrogen and R^9 is hydrogen, methyl or ethyl. Where R^9 is hydrogen, methyl or ethyl, the alkylene glycol will usually be derived from ethylene, propylene or butylene oxides respectively. Each of the $[CHR^8CHR^9O]$ groups can be the same of different.

[0021] R^4 may also be an arylene, alkarylene or aralkylene group, e.g of 6-20 or 7-20 carbons such as phenylene $-C_6H_4-$; benzylene $-CH_2C_6H_4-$; biphenylene $-C_6H_4-C_6H_4-$: methylene diphenylene $-C_6H_4CH_2C_6H_4-$; naphthylene $-C_{10}H_8-$ or $-C_6H_4C(CH_3)_2-C_6-H_4-$.

[0022] Alternatively R_4 may comprise at least one acrylate, acrylamide or oxirane group, eg $R_4 = -[CAB]_p-$ where p is an integer from 1 to 10, eg 3-5; each of A and B is independently the group



or



wherein q and r are independently zero or an integer from 1 to 5 (this group preferably representing group A in at least one part of R^4) or each of A and B is independently hydrogen, R^7, a hydroxy alkyl, each of the p groups -[CAB]- may be the same or different, R^3, Z, R^5 and R^7 are all as defined above, and each alkylene group preferably has 1-6 carbons.

[0023] Preferably alkylene in the group A is methylene.

When B is a hydroxy alkyl group it is preferably hydroxy ethyl.

[0024] R^4 is preferably an alkylene or an alkylene glycol, especially in the form $-CHR^7CABCHR^7-$.

[0025] Where R^3 or R^5 is a hydrocarbyl group it is preferably a C_1-C_6 alkyl group.

[0026] R^3 and R^5 are preferably hydrogen or methyl.

[0027] An example of a suitable epoxyacrylate having the formula III is glycidylacrylate. The dispersant having the formula (II) is reacted with the epoxyacrylate having the formula (III) in two or more sequential steps. Thus, the reaction of the dispersant with the epoxyacrylate comprises in a first step reacting dispersant at elevated temperature with epoxyacrylate, and in a further step or steps reacting the product from the preceding step or steps with further dispersant.

[0028] It will be appreciated that in the subsequent sequential step or steps involving the addition of further dispersant, a different dispersant or dispersants to that used in the first step may be employed.

[0029] It is preferred to effect the reaction in a suitable solvent. In view of the fact that dispersants are generally marketed as solutions in lubricating oils and in view of the intended use of the product, it is preferred to employ a lubricating oil as the solvent. Both natural and synthetic lubricating oils may be employed. Cosolvents may also be used if desired. Suitable cosolvents include liquid hydrocarbons, for example xylene and toluene.

[0030] The elevated temperature at which the reaction is effected may be above 70°C and below the decomposition temperature of any of the components of the reaction mixture.

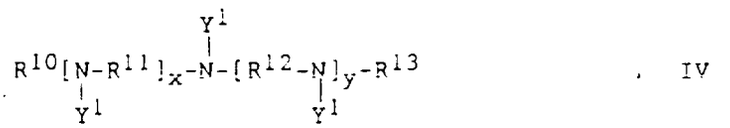
[0031] The two step process may suitably comprise (i) mixing the dispersant and the epoxyacrylate at a temperature of from ambient to 120°C (ii) in the event that the temperature or the mixture is less than 70°C, raising its temperature to a value above 70°C and below the decomposition temperature of the mixture over a period, for example from 10 to

180 minutes, (iii) maintaining the mixture at this temperature for a period, for example from 15 to 300 minutes, (iv) adding a further portion of a dispersant, suitably preheated to a temperature up to 220°C, and (v) maintaining the temperature of the mixture at a value in the range from 70 to 250°C for a period, suitably from 15 to 300 minutes, at either atmospheric or subatmospheric pressure.

[0032] In the aforesaid two step (or multistep) reaction 0.75 or more, preferably from 0.85 to 1.1 equivalents of epoxyacrylate may be used in the first step for each amino hydrogen present in the dispersant. Thereafter in the subsequent step or steps, from 0.5-15, preferably 1-10 equivalents of dispersant per equivalent of dispersant used in the first step may be used.

[0033] The process may be operated batchwise or continuously.

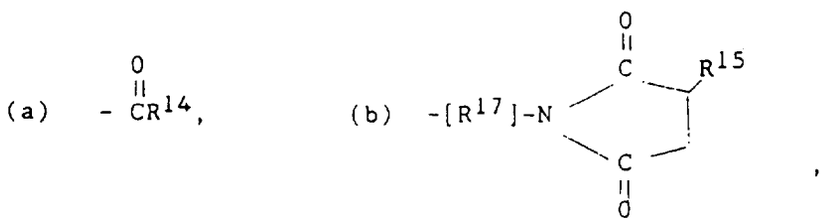
[0034] Products of the first step of a 2-step or multistep reaction of a dispersant as described hereinabove and a polyacrylate of formula III comprise a novel compound of the general formula IV:

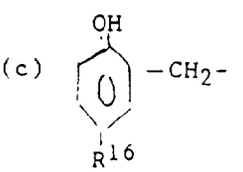


IV

where R^{11} and R^{12} are independently a divalent aliphatic, hetero-substituted aliphatic, aromatic or hetero-substituted aromatic group. eg as defined for R^2 and with any aromatic groups containing 6-20 carbons such as phenylene.

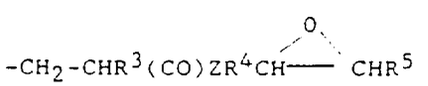
[0035] R^{10} and R^{13} are independently a hydrocarbyl group, or





or the group Y^1, preferably (b),

Y^1 is



or H_2C= $CR^3(CO)ZR^4CHR'CHR"R^5$-where one of R' and R" is hydroxyl, R^4 is alkylene or arylene, and Z is preferably oxygen,

R^{11} and R^{12} are preferably $-CH_2CH_2-$.

R^{14}, R^{15} and R^{16} are independently a hydrocarbyl group.

R^{17} is a divalent aliphatic or hetero (eg 0) substituted aliphatic group, eg as defined for R^2,

x and y are independently zero or an integer from 1 to 10, preferably 2 to 7,

each group R^{11}, each R^{12}, and each group Y^1 can be the same or different,

R^3, R^5, R^6 and Z are as defined above, R^3 and R^5 preferably being hydrogen or methyl.

[0036] Where R^{10}, R^{13}, R^{14}, R^{15} or R^{16} is a hydrocarbyl group eg of 1-300 carbons it is preferably derived from a polyolefin which is derived from a C_1-C_8 terminal or internal olefin e.g polyethylene, polypropylene or polyisobutene

preferably polyisobutene. Preferably it is a C_{30}-C_{300} alkyl group more preferably C_{50}-C_{150}.

R^{17} is suitably ethylene or propylene.

[0037] The reactions are performed in the absence of any catalyst which is active in the polymerisation of epoxyacrylates. By the avoidance of such catalysts the production of polymerised epoxyacrylates can be substantially avoided.

[0038] The lubricating oil may be any natural or synthetic lubricating oil.

[0039] Into the lubricating oil composition there may also be incorporated any of the conventional additives normally employed, which additives include antioxidants, detergents, extreme pressure/anti-wear agents and viscosity index improvers. It is an advantage of the present invention that, because the dispersant composition of the invention has viscosity index properties, less of the conventional viscosity index improver may be required.

[0040] The lubricating oil composition may be used for any lubricating application, including automotive and marine use.

[0041] For automotive use the lubricating oil composition may suitably contain up to 10% (eg 0.01-10% or 2-10%) by weight of the dispersant additive of the present invention.

[0042] For marine engine use the lubricating oil composition may suitably contain up to 10% (eg 0.01-10% or 2-10%) by weight of the dispersant additive of the present invention.

[0043] The invention will now be illustrated by reference to the following Examples.

[0044] In all the Examples there was used a commercially available succinimide dispersant formed by the reaction or a polyisobutene (M_n about 1000) - substituted succinic anhydride and tetraethylene pentamine.

[0045] In the Table reference is made to LZ 6420, which is a dispersant having VI credit marketed by Lubrizol. It is used for comparison purposes.

Example

[0046] The succinimide dispersant was combined with four equivalents of glycidylacrylate at 20°C. The mixture was heated to 110°C over 35 minutes and maintained at this temperature for 35 minutes. A further two equivalents of the succinimide dispersant at a temperature of 75°C were added to the mixture. The mixture was heated at 120°C for 240 minutes at atmospheric pressure and for 90 minutes at reduced pressure (60mm Hg).

[0047] The viscosities of 11.0% b.w. lubricating oil solutions of the product were determined at -20°C, 40°C and 100°C. The measured values are presented in the accompanying Table.

Table

	Concn. of product** (% b.w.)	Concn. of actives* (% b. w.)	VISCOSITY			VI
			-20°C c/s	40°C c/s	100°C c/s	
LZ6420	-	5.5	38.00	53.2	8.38	131
Succinimide	11.0	5.5	35.75	43.2	6.76	108
Succinimide:GA:	11.0	5.9	32.3	43.2	7.32	132
Succinimide 1 : 4 : 2	13.0	7.0	-	45.1	7.74	139

* 'Actives' refers to any material that is not mineral oil, ie amount of succinimide + epoxyacrylate derived products present by weight.

** 'Concn of product' refers to % weight of end material (which contains oil already) diluted in oil.

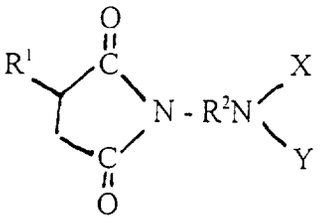
Claims

1. A process for preparing an oil-soluble compound suitable for use as a dispersant additive, which compound is obtained by reacting at elevated temperature an epoxyacrylate with a dispersant having at least one reactive nitrogen containing moiety in two or more sequential steps, comprising a first step of reacting the dispersant at elevated temperature with epoxyacrylate, and in a further process step or steps involving the addition of further dispersant, reacting the product from the preceding step or steps with further dispersant.

2. A process as claimed in claim 1 wherein the epoxyacrylate is used in an amount in the range 0.85 to 1.1 equivalents of epoxyacrylate to amino hydrogens present in the dispersant used in the first step.

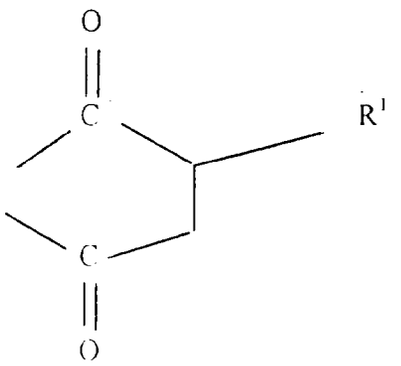
3. A process as claimed in any preceding claim wherein the dispersant is an imide or amide formed by the reaction of a polyalkene substituted succinic acylating agent and an amine.

4. A process as claimed in any preceding claim wherein the imide is a succinimide of formula



(I)

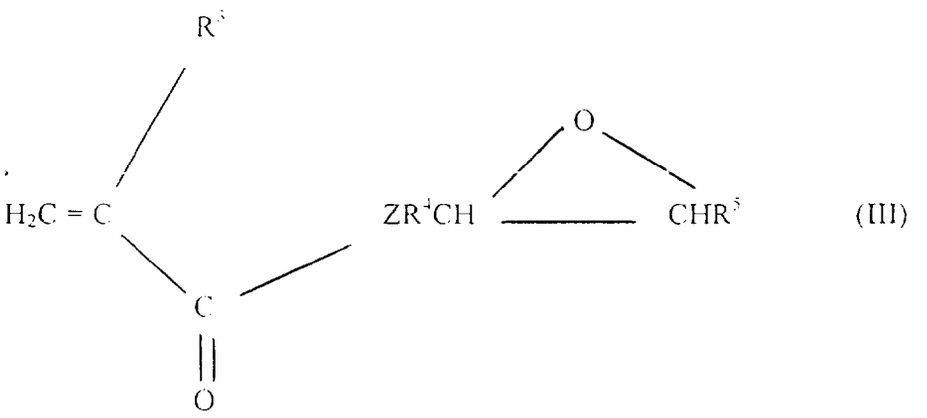
wherein R^1 is a polyalkene group having more than 30 carbon atoms and R^2 is a divalent group such that H_2NR^2NXY is an alkylene amine, an alkanolamine, a polyetheramine an aromatic or araliphatic amine, X and Y are independently a hydrogen, an alkyl group or hydroxy alkyl group or together form a group.



5. A process as claimed in claim 4 wherein R^1 is a polyisobutene group.

6. A process as claimed in any preceding claim wherein the dispersant contains between 3 and 7 active nitrogens.

7. A process as claimed in any preceding claim wherein the epoxyacrylate has the formula III:



(III)

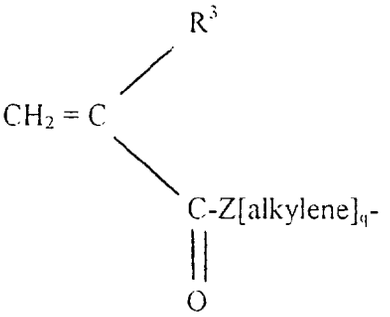
wherein R^3 and R^5 are independently either hydrogen, a hydrocarbyl or a hetero-substituted hydrocarbyl group, R^4 is alkylene, alkylene glycol, aryl or a group containing at least one of an acrylate, acrylamide or oxirane group, Z is a heteroatom or substituted heteroatom.

8. A process as claimed in claim 7 wherein R^4 is an alkylene group of formula - $[CHR^7]_n$- where R^7 is hydrogen or a C_1-C_6 alkyl group and each of the n-$[CHR^7]$-groups can be the same or different.

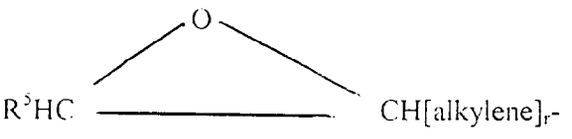
9. A process as claimed in claim 7 wherein R^4 is a group containing at least one of an acrylate, acrylamide or oxirane group of the formula :

$$R_4 = -[CAB]_p$$

where p is an integer from 1 to 10, each of A and B is independently the group



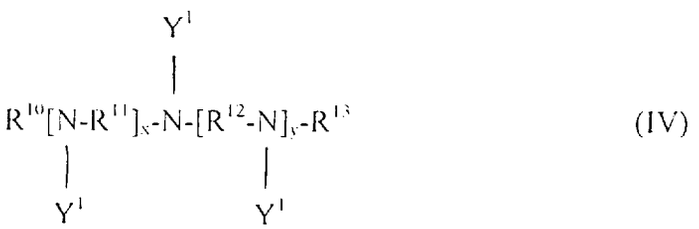
or



wherein q and r are independently zero or an integer from 1 to 5, or each of A and B is independently hydrogen, R^7, a hydroxl alkyl, each of the p groups -[CAB]- may be the same or different, R^3, Z and R^5 are is defined in claim 7, R^7 is as defined in claim 6.

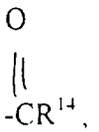
10. A process is claimed in any one of claims 6 to 8 wherein R^3 and R^5 are independently hydrogen or methyl.

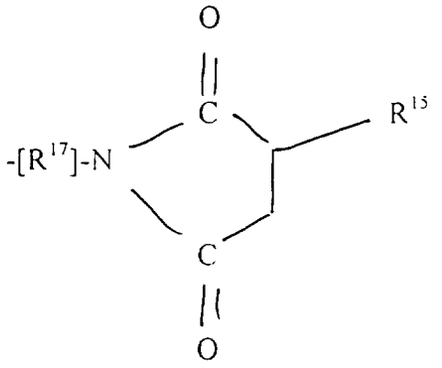
11. A process according to claim 1 wherein the dispersant has the formula IV:

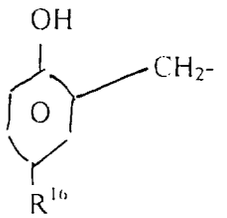


(IV)

where R^{11} and R^{12} are independently a divalent aliphatic, hetero-substituted aliphatic, aromatic or hetero-substituted aromatic group, R^{10} and R^{13} are independently a hydrocarbyl group, or

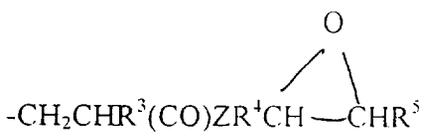




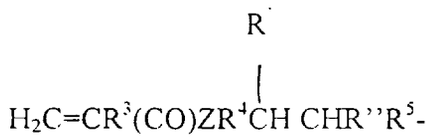


or the group Y1

Y1 is



or



where one of R' and R'' is hydroxyl group,

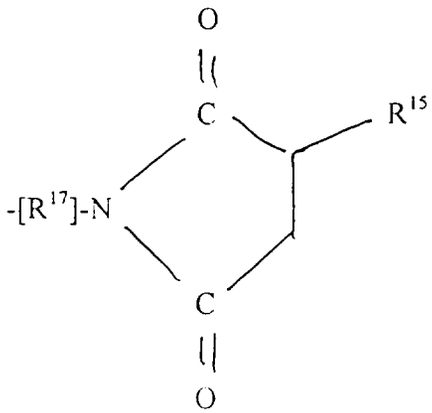
R^{14}, R^{15} and R^{16} are independently a hydrocarbyl group,

R17 is an aliphatic or hetero substituted aliphatic group,

x and y are independently zero or an integer from 1 to 10, each group R^{11} each group R^{12} and each group Y^1 can be the same or different.

R^3, R^4, R^5 and Z are as defined in claim 7.

12. A process as claimed in claim 11 wherein R^{10} and R^{13} are :



R^{11} and R^{12} are $-CH_2CH_2-$

x + y is an integer from 2 to 7,
R^3 and R^5 are independently hydrogen or methyl,
Z is oxygen,
R^4 is an alkylene or arylene group.

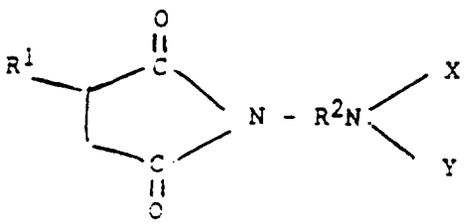
Patentansprüche

1. Verfahren zur Herstellung einer in Öl löslichen Verbindung, die zur Verwendung als ein Dispergiermittelzusatz geeignet ist, welche Verbindung durch Umsetzen eines Epoxyacrylats mit einem Dispergiermittel, das wenigstens eine reaktiven Stickstoff enthaltende Einheit besitzt, bei erhöhter Temperatur in zwei oder mehreren aufeinanderfolgenden Schritten erhalten wird, umfassend einen ersten Schritt der Umsetzung des Dispergiermittels bei erhöhter Temperatur mit Epoxyacrylat und in einem weiteren Verfahrensschritt oder in weiteren Verfahrensschritten, der/die die Zugabe weiteren Dispergiermittels einschließt/einschließen, die Umsetzung des Produkts aus dem vorangehenden Schritt oder den vorangehenden Schritten mit weiterem Dispergiermittel.

2. Verfahren, wie in Anspruch 1 beansprucht, worin das Epoxyacrylat in einer Menge im Bereich von 0,85 bis 1,1 Äquivalenten Epoxyacrylat zu den Amino-Wasserstoffen, die in dem im ersten Schritt verwendeten Dispergiermittel vorhanden sind, verwendet wird.

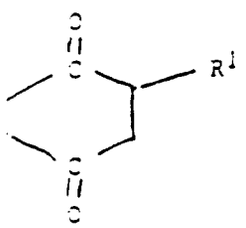
3. Verfahren wie in einem vorhergehenden Anspruch beansprucht, worin das Dispergiermittel ein Imid oder Amid ist, das durch die Reaktion eines mit einem Polyalken substituierten succinischen Acylierungsmittels und eines Amins gebildet wird.

4. Verfahren, wie in einem vorhergehenden Anspruch beansprucht, worin das Imid ein Succinimid der Formel:



(I)

ist, worin R^1 eine Polyalkengruppe mit mehr als 30 Kohlenstoffatomen ist und R^2 eine solche zweiwertige Gruppe ist, daß H_2NR^2NXY ein Alkylenamin, ein Alkanolamin, ein Polyetheramin, ein aromatisches oder araliphatisches Amin ist. X und Y unabhängig voneinander ein Wasserstoffatom, eine Alkylgruppe oder Hydroxyalkylgruppe sind oder zusammen eine Gruppe

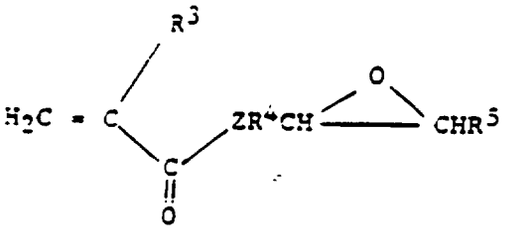


bilden.

5. Verfahren, wie in Anspruch 4 beansprucht, worin R^1 eine Polyisobutengruppe ist.

6. Verfahren, wie in einem vorhergehenden Anspruch beansprucht, worin das Dispergiermittel zwischen 3 und 7 aktive Stickstoffatome enthält.

7. Verfahren, wie in einem vorhergehenden Anspruch beansprucht, worin das Epoxyacrylat die Formel III:



(III)

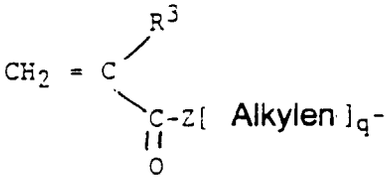
besitzt, worin R^3 und R^5 unabhängig voneinander entweder ein Wasserstoffatom, eine Kohlenwasserstoff- oder eine hetero-substituierte Kohlenwasserstoffgruppe sind, R^4 eine Alkylen-, Alkylenglykol-, Arylgruppe oder eine Gruppe mit wenigstens einer Acrylat-, Acrylamid- oder Oxirangruppe ist, Z ein Heteroatom oder ein substituiertes Heteroatom ist.

8. Verfahren, wie in Anspruch 7 beansprucht, worin R^4 eine Alkylengruppe der Formel $-[CHR^7]_n-$ ist, wobei R^7 ein Wasserstoffatom oder eine C_1- $-C_6$-Alkylgruppe ist, und jede der n $-[CHR^7]-$-Gruppen gleich oder verschieden sein kann.

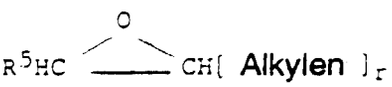
9. Verfahren, wie in Anspruch 7 beansprucht, worin R^4 eine Gruppe ist, die wenigstens eine Acrylat-, Acrylamid- oder Oxirangruppe der Formel

$$R_4 = -[CAB]_p$$

enthält, wobei p eine ganze Zahl von 1 bis 10 darstellt, jedes von A und B unabhängig voneinander die Gruppe



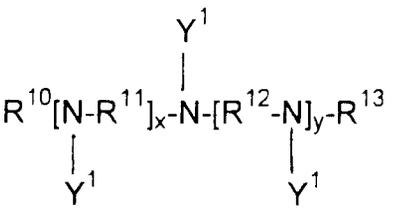
oder



ist, worin q und r unabhängig voneinander Null oder eine ganze Zahl von 1 bis 5 darstellen, oder jedes von A und B unabhängig voneinander ein Wasserstoffatom,
R^7, eine Hydroxyalkylgruppe ist, und jede der p $-[CAB]-$-Gruppen gleich oder verschieden sein kann.
R^3, Z und R^5 wie in Anspruch 7 definiert sind,
R^7 wie in Anspruch 6 definiert ist.

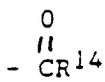
10. Verfahren, wie in einem der Ansprüche 6 bis 8 beansprucht, worin R^3 und R^5 unabhängig voneinander ein Wasserstoffatom oder eine Methylgruppe sind.

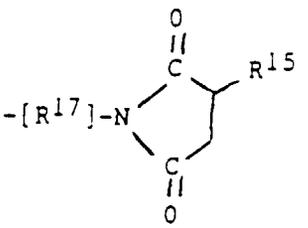
11. Verfahren gemäß Anspruch 1. worin das Dispergiermittel die Formel IV:

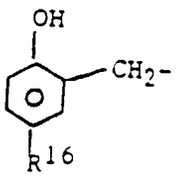


(IV)

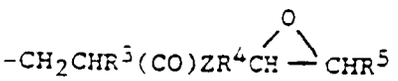
hat, worin R^{11} und R^{12} unabhängig voneinander eine zweiwertige aliphatische, hetero-substituierte aliphatische, aromatische oder hetero-substituierte aromatische Gruppe ist,
R^{10} und R^{13} unabhängig voneinander eine Kohlenwasserstoffgruppe oder



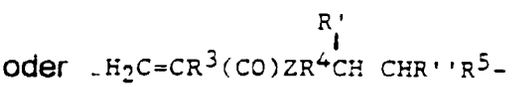




oder die Gruppe Y^1 sind,
Y^1

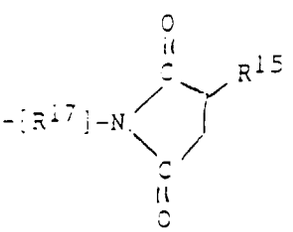


oder



ist, worin eines von R' und R" ein Wasserstoffatom und das andere eine Hydroxylgruppe ist,
R^{14}, R^{15} und R^{16} unabhängig voneinander eine Kohlenwasserstoffgruppe sind,
R^{17} eine aliphatische oder hetero-substituierte aliphatische Gruppe ist,
x und y unabhängig voneinander Null oder eine ganze Zahl von 1 bis 10 darstellen, jede Gruppe R^{11}, jede Gruppe R^{12} und jede Gruppe Y^1 gleich oder verschieden sein können,
R^3, R^4, R^5, Z wie in Anspruch 7 definiert sind.

12. Verfahren, wie in Anspruch 11 beansprucht, worin R^{10} und R^{13}



sind,

R^{11} und R^{12} $-CH_2CH_2-$ sind,
x+y eine ganze Zahl von 2 bis 7 darstellt,
R^3 und R^5 unabhängig voneinander ein Wasserstoffatom oder eine Methylgruppe sind,
Z Sauerstoff ist,
R^4 eine Alkylen- oder Arylengruppe ist.

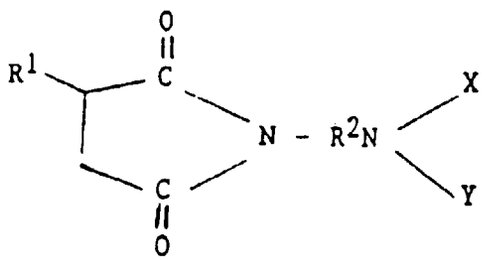
Revendications

1. Procédé pour préparer un composé liposoluble approprié pour une utilisation en tant qu'additif dispersant, composé qui est obtenu en faisant réagir à température élevée un époxyacrylate avec un dispersant ayant au moins une fraction contenant de l'azote réactif en deux ou plusieurs étapes successives, comprenant une première étape consistant à faire réagir le dispersant à une température élevée avec l'époxyacrylate, et dans une ou des étapes de procédé supplémentaires, comportant l'addition de dispersant supplémentaire, consistant à faire réagir le produit provenant de la ou des étapes avec un supplément de dispersant.

2. Procédé selon la revendication 1, dans lequel l'époxyacrylate est utilisé à raison de 0,85 à 1,1 équivalent d'époxyacrylate par rapport aux amino-hydrogènes présents dans le dispersant utilisé dans la première étape.

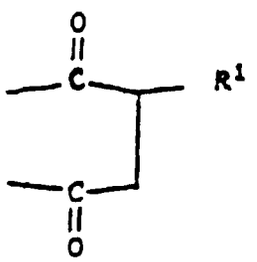
3. Procédé selon l'une des revendications précédentes, dans lequel le dispersant est un imide ou amide formé par la réaction d'un agent d'acylation succinique à substitution polyalcène et d'une amine.

4. Procédé selon l'une des revendications précédentes, dans lequel l'imide est un succinimide de formule:



(I)

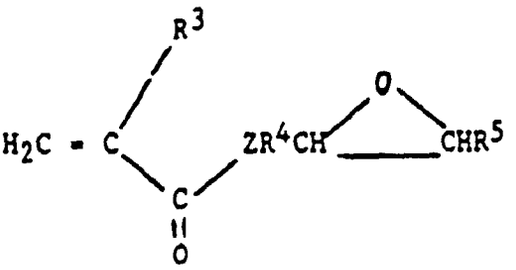
dans laquelle R^1 est un groupe polyalcène ayant plus de 30 atomes de carbone et R^2 est un groupe divalent tel que H_2NR^2NXY soit une alkylèneamine, une alcanolamine, une polyétheramine, une amine aromatique ou aliphatique, X et Y sont indépendamment un atome d'hydrogène, un groupe alkyle ou un groupe hydroxyalkyle ou forment ensemble un groupe



5. Procédé selon la revendication 4, dans lequel R^1 est un groupe polyisobutène.

6. Procédé selon l'une des revendications précédentes, dans lequel le dispersant contient entre 3 et 7 azotes actifs.

7. Procédé selon l'une des revendications 1 à 6, dans lequel l'époxyacrylate a la formule III:



(III)

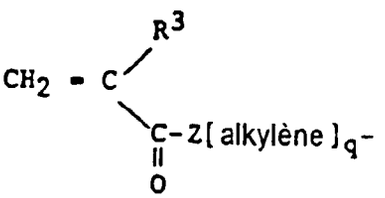
dans laquelle R^3 et R^5 sont, indépendamment l'un de l'autre, un atome d'hydrogène, un groupe hydrocarbyle, ou un groupe hydrocarbyle hétéro-substitué, R^4 est un groupe alkylène, alkylèneglycol, aryle ou un groupe contenant au moins un parmi les groupes acrylate, acrylamide ou oxirane, Z est un hétéroatome ou un hétéroatome substitué.

8. Procédé selon la revendication 7, dans lequel R^4 est un groupe alkylène de formule $-[CHR^7]_n-$ dans laquelle R^7 est un atome d'hydrogène ou un groupe alkyle en C_1 à C_6, et chacun des n groupes $-[CHR^7]-$ peut être identique ou différent.

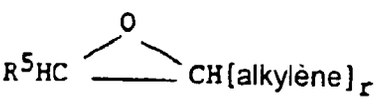
9. Procédé selon la revendication 7, dans lequel R^4 est un groupe contenant au moins un des groupes acrylate, acrylamide ou oxirane de formule

$$R_4 = -[CAB]_p$$

dans laquelle p est un nombre entier de 1 à 10, chaque A et B est indépendamment le groupe



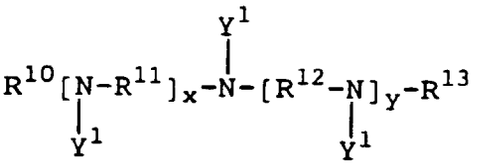
ou



dans lequel q et r valent indépendamment zéro ou sont un nombre entier de 1 à 5, ou bien chaque A et B est indépendamment un atome d'hydrogène, R^7, un groupe hydroxyalkyle, chacun des p groupes $-[CAB]-$ peut être identique ou différent,
R^3, Z, et R^5 sont tels que définis dans la revendication 7, R^7 est tel que défini dans la revendication 6.

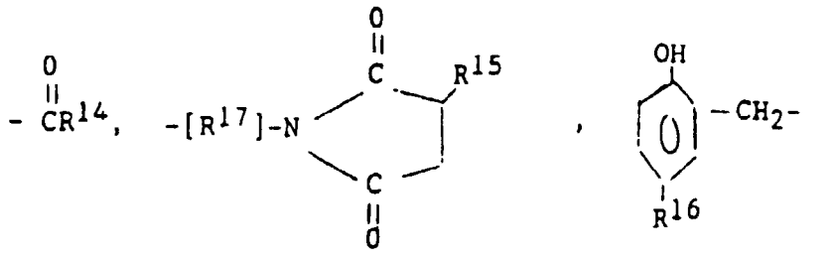
10. Procédé selon l'une des revendications 6 à 8, dans lequel R^3 et R^5 sont indépendamment un atome d'hydrogène ou un groupe méthyle.

11. Procédé selon la revendication 1, dans lequel le dispersant possède la formule IV:

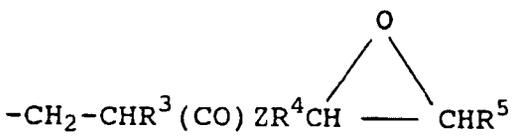


IV

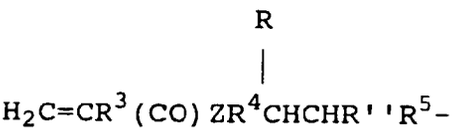
dans laquelle R^{11} et R^{12} sont, indépendamment l'un de l'autre, un groupe divalent aliphatique, aliphatique hétéro-substitué, aromatique ou aromatique hétéro-substitué,
R^{10} et R^{13} sont indépendamment un groupe hydrocarbyle, ou



ou le groupe Y^1,
Y^1 est

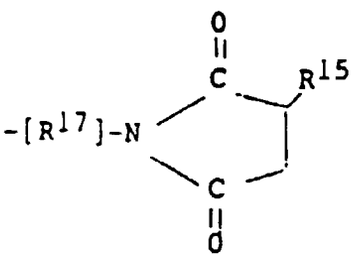


ou



où l'un de R' et R" est un atome d'hydrogène et l'autre est un groupe hydroxyle,
R^{14}, R^{15} et R^{16} sont indépendamment un groupe hydrocarbyle,
R^{17} est un groupe aliphatique ou aliphatique hétéro-substitué,
x et y valent indépendamment zéro ou sont un nombre entier de 1 à 10,
chaque groupe R^{11}, chaque groupe R^{12} et chaque groupe Y^1 peuvent être identiques ou différents,
R^3, R^4, R^5 et Z sont tels que définis dans la revendication 7.

12. Procédé selon la revendication 11, dans lequel R^{10} et R^{13} sont:



R^{11} et R^{12} sont $-CH_2CH_2-$,
x + y est un nombre entier de 2 à 7,
R^3 et R^5 sont, indépendamment, un atome d'hydrogène ou un groupe méthyle,
Z est un atome d'oxygène,
R^4 est un groupe alkylène ou arylène.